SUBSTITUTE SPECIFICATION FOR PCT/GB2004/001511

CLAIMS

1. A method for removing non-condensing gas from a mixture of condensing and non-condensing gases in a condenser, wherein gas is withdrawn from at least one location within the condenser, the location being selected to correspond to a region within the condenser in which the gas is at a temperature which is lower than the temperature of gas in other regions within the condenser.

2. A condenser for condensing gas in which gas is condensed to liquid on a heat exchanging surface, comprising means for withdrawing gas from within the condenser to remove non-condensing gas, the gas withdrawing means being positioned to withdraw gas from at least one location in which the gas temperature is lower than in other regions within the condenser.

3. A condenser according to claim 2, wherein the gas withdrawing means comprises cooling means for producing a localised region of relatively cold gas in the location from which gas is withdrawn.

4. A condenser according to claim 3, wherein the cooling means comprise a heat exchanger on which gas condenses.

5. A condenser according to claim 3 or 4, wherein the cooling means comprises means positioned to be cooled by condensing liquid.

6. A condenser according to claim 5, wherein the cooling means comprises at least one deflector located beneath the heat exchanging surface such that droplets of liquid fall onto and cool the deflector, the gas withdrawing means extracting air from beneath the deflector.

7. A condenser according to claim 6, wherein the or each deflector is a cover extending over an upwardly extending gas withdrawal pipe.

8. A condenser according to claim 6, wherein the or each deflector is an elongate gas withdrawal duct a lower side of which defines apertures through which gas is withdrawn into the elongate duct.

9. A condenser according to claim 6, wherein the or each deflector is an elongate duct an underside of which defines an open channel, the gas withdrawing means being connected to one end of the elongate duct.

10. A condenser according to claim 8 or 9, wherein the elongate duct extends beneath and in parallel with a heat exchanger tube of the condenser.

11. A condenser according to claim 6, 7, 8, 9 or 10, wherein a shield is located above the or each deflector to shield falling droplets of condensate from gas flowing through the condenser.

12. A condenser according to claim 3, wherein the cooling means comprises a surface which is cooled by a flow of coolant.

13. A condenser according to claim 12, wherein the surface of the cooling means is cooled by a flow of coolant to a temperature lower than any heat exchange surface within the condenser.

14. A condenser according to claim 12, wherein the cooling means comprises primary and secondary heat exchangers both defining heat exchange surfaces, the heat exchange surface of the primary heat exchanger being located upstream of the heat exchange surface of the secondary heat exchanger in the flow of gas to be condensed, and the secondary heat exchanger being cooled to a lower temperature than the primary heat exchanger.

15. A condenser according to claim 14, wherein the primary and secondary heat exchangers are cooled by flows of coolant derived from separate sources, the coolant of the secondary heat exchanger being at a lower temperature than the coolant of the first heat exchanger.

16. A condenser according to any one of claims 2 to 15, comprising an auxiliary heat exchanger within the condenser, and means for pumping condensed liquid through the auxiliary heat exchanger, the auxiliary heat exchanger being located such that the condensed liquid within it is heated by the gas to be condensed.

17. A condenser according to claim 16, wherein the auxiliary heat exchanger is located upstream of the said heat exchanging surface in the flow of gas to be condensed.

18. A condenser according to claim 12, wherein the cooled surface is defined by a pool of condensed liquid in thermal contact with a cooling device.

19. A condenser according to claim 12, wherein the cooled surface is defined by a wall of the condenser in thermal contact with a cooling device.

20. A condenser according to claim 19, wherein the condenser wall is defined by a cover plate which covers an aperture in the condenser, gas being withdrawn through the cover plate.

21. A condenser according to claim 20, comprising means for monitoring the pressure and temperature of gas adjacent the cover plate, and means for controlling the cooling means to maintain the temperature of the cover plate above the freezing point of the condensed liquid.

22. A method for establishing favourable temperature differences between heat exchanger conduits within a condenser and a process fluid which flows through the condenser, wherein coolant is pumped through an array of parallel heat exchanger conduits spaced apart in the direction of process fluid flow, at least two of the conduits being connected in series such that coolant flows sequentially through first and second conduits, the second conduit being located upstream of the first conduit in the direction of process fluid flow.

23. A condenser comprising an array of parallel heat exchanger conduits spaced apart in the direction of flow of a process fluid flow including a gas to be condensed, wherein at least two conduits that are spaced apart in the direction of fluid flow are connected in series such that

coolant flows sequentially through first and second conduits, the second conduit being located upstream of the first conduit in the direction of process fluid flow.

24. A condenser according to claim 23, wherein a first pair of first and second conduits are connected in series, a second pair of first and second conduits are connected in series, the direction of flow of coolant through the condenser being in one direction for the first conduit of the first pair and the second conduit of the second pair and in the opposite direction for the second conduit of the first pair and the first conduit of the second pair, the second conduit of the first pair being located upstream in the process flow of the first conduit of the second pair, and the second conduit of the second pair being located upstream in the process flow of the first conduit of the first pair.

25. A condenser according to claim 23 or to claim 24, wherein the parallel heat exchanger conduits comprise parallel heat exchanger tubes.

26. A condenser according to claim 23, wherein the parallel heat exchanger conduits are defined by a staggered array of baffles, each baffle extending transverse the direction of flow of the process fluid, with alternate baffles extending from opposite sides of the condenser, the condenser further comprising an array of process fluid tubes extending through the baffles for said flow of the process fluid.

27. A method for minimising the pressure within a containment vessel resulting from the release into the vessel of a pressurised gas which will condense to a liquid at the temperatures

and pressures assumed to prevail within the containment vessel, wherein a body of the liquid of large surface area relative to the area of the vessel is established in a lower portion of the vessel.

28. A containment vessel intended to contain a release into the vessel of pressurised gas which will condense to a liquid at the temperatures and pressures assumed to prevail within the containment vessel, the containment vessel initially being filled with a gas or gases which will not condense at the temperatures and pressures assumed to prevail within the containment vessel, and the containment vessel including means for establishing in a lower portion of the vessel a body of the liquid of large surface area relative to the area of the vessel.

29. The containment vessel according to claim 28, comprising at least one open tray arranged to collect condensing liquid to form the said body of liquid.

30. A containment vessel according to claim 28, comprising means for releasing a stored volume of the liquid into at least one open tray to form the said body of liquid.

31. A containment vessel according to claim 30, comprising means for sensing pressure within the containment vessel, and means for releasing the stored volume of liquid in the event of the sensed pressure exceeding a predetermined threshold.

32. A condenser substantially as hereinbefore described with reference to any one or more of Figures 8 to 15 and 17.

33. A containment vessel substantially as hereinbefore described with reference to Figure 16.

34. A method for removing non-condensing gas from a mixture of condensing and non-condensing gases in a condenser, comprising:

providing a condenser with a flowing mixture which includes a condensing gas and a non-condensing gas;

cooling the flowing mixture in the condenser;

providing a region of relative low mixture temperature within the condenser;

forming condensate in the condenser proximate to the region; and

withdrawing the non-condensing gas from the region.

35. An apparatus for condensing gas to liquid, comprising:

a condenser for transferring heat from a gas, said condenser having an interior with a region of relative low temperature during operation of said condenser, the region being proximate formed condensate during operation of said condenser; and

means for withdrawing gas from the region of said condenser.

36. A method of removing heat from a condensable process fluid, comprising:

providing a condenser through which the process fluid flows in a direction;

placing a plurality of parallel heat exchanger conduits in the condenser and spacing apart the conduits in the direction of flow of the process fluid, the conduits accepting a flow of coolant;

connecting the flowpath of a first conduit and the flowpath of a second conduit in series;

flowing coolant from the first conduit through the second conduit; and

locating the second conduit upstream of the first conduit relative to the direction of flow of the process fluid.

37. A method for condensing a liquid from a gas, comprising:

providing a containment vessel having an interior and an internal surface area, and a heated gas generator within the containment vessel for producing a heated supply of condensable gas;

expelling a portion of the heated supply of condensable gas into the interior of the containment vessel;

cooling the expelled portion to produce a corresponding quantity of condensate; and

collecting the condensate in a pool within a lower portion of the containment vessel, the condensate having a surface area, the surface area of the condensate being large relative to the internal surface area of the containment vessel.